APPENDIX C:
DOMINGUEZ CHANNEL AND GREATER LOS ANGELES AND LONG BEACH HARBOR WATERS CURRENT CONDITION

1 Introduction

The current condition of the Dominguez Channel and Greater Los Angeles and Long Beach waters was assessed using data collected as part of the TMDL monitoring from 2013 up to 2018. For this review, data was examined in detail for the waters addressed by the TMDL in the Dominguez Channel and Torrance Lateral; Los Angeles River Estuary; San Gabriel River Estuary; and Greater Harbor Waters. When sufficient data was available, a determination was made of whether a waterbody (and associated responsible parties) was in compliance requirements of the with the TMDL.

In some cases, only two or three years of data were available. While the TMDL was effective in 2012, it took several years for monitoring groups to form, for monitoring plans to be submitted and approved and for monitoring to commence. Therefore, for data collected per the requirements of the TMDL, only two or three years of data were available. Implementation efforts including a discussion of the monitoring groups are detailed in Section 4.7 of the Staff Report.

2. Data Used for the Current Condition Assessment

The data used for the current condition assessment is provided in tale below:

Table 1 Water, sediment and fish tissue data reviewed for current condition

No.	Data Sources	Data Record	Water Bodies Covered	Sample Media
01	Bight Data The Regional Marine Monitoring Program, 'Bight,' is a collaborative coastal monitoring program that is facilitated by SCCWRP. Bight is conducted every 5 years.	2013 & 2018	Greater Los Angeles and Long Beach Harbor Waters	Water, sediment, and fish
02	Greater Los Angeles and Long Beach Harbor Waters Annual Monitoring Program (TMDL required monitoring)	2015-2018	Greater Los Angeles and Long Beach Harbor Waters	Water, sediment, and fish
03	Dominguez Channel Watershed Management Area Group – Coordinated Integrated Monitoring Program (TMDL required monitoring)	2015-2017	Dominguez Channel	Water and sediment
04	Lower Los Angeles River Coordinated Integrated Monitoring Program (TMDL required monitoring)	2015-2017	Los Angeles River Estuary	Water and sediment
05	Lower San Gabriel River Coordinated Integrated Monitoring Program (TMDL required monitoring)	2015-2017	San Gabriel River Estuary	Water and sediment
06	Amec Foster Wheeler – Harbor Toxics TMDL Watershed Loading Estimation – Storm Water Monitoring	2014-2015	Dominguez Channel	Water

3. Dominguez Channel and Torrance Lateral

Monitoring data collected for Dominguez Channel and Torrance Lateral were limited to two years of monitoring data, 2015-2016 and 2016-2017 submitted by the Dominguez Channel Watershed Management Group.

3.1 Water Column

Current condition: The assessment for Dominguez Channel and Torrance Lateral is based on two years of monitoring data, 2015-2016 and 2016-2017. The adopted TMDL only assigned interim and final allocations to Dominguez Channel for wet weather because exceedances were only observed in wet weather. Monitoring was required for both wet and dry weather.

Dry weather data were analyzed and compared to chronic CTR numeric targets for freshwater. Copper concentrations were above the CTR and ranging from 13 to 32.7ug/L. Lead and zinc concentrations in receiving water are currently meeting the CTR numeric targets. A summary of the dry weather data is provided in Table 2.

Interim allocations in wet weather (interim allocations were required to be met at the time the TMDL became effective): Copper, lead and zinc, are meeting the interim allocation limits in wet weather except for one exceedance for both copper and zinc.

Final allocations in wet weather: At this time, only lead concentrations in all samples are below the final allocation. Both copper and zinc concentrations are above the final allocations and range from 14.8-222 ug/L for copper and 103-318.1 ug/L for Zinc.

The number of total samples, exceedances, and frequency of exceedances for wet weather are summarized in Table 3.

Table 2 Water Column Data Summary (2015-2016 and 2016-2017) for Metals in Dominguez Channel Freshwater Water , Dry Weather

Chemical	Sample Count	Minimum (ug/L)	Maximum (ug/L)	Average (ug/L)	Data Above CTR Target
Total Copper	6	6.21	32.7	20.8	3
Total Lead	6	0.500	1.05	0.794	0
Total Zinc	5	9.58	61.1	25.8	0

Table 3 Water Column Data Summary (2015-2016 and 2016-2017) for Metals in Dominguez Channel Freshwater, Wet Weather

Chemical	Sample Count	Minimum (ug/L)	Maximum (ug/L)	Average (ug/L)	Wet Weather Interim Allocation (ug/L)	Wet Weather Final Allocation (ug/L)	Number of Interim Exceedances
Total Copper	14	14.8	222	54.7	207	9.70	1
Total Lead	14	6.72	62.3	18.0	123	42.7	0
Total Zinc	12	103.0	1270	318.1	898.9	69.7	1

3.2 Sediment and Fish Tissue

Monitoring data for sediment and fish tissue were not reported in the 2015-2016 and 2016-2017 annual reports. The Dominguez Channel Watershed Management Group indicated that because the Dominguez Channel and Greater Harbor Waters TMDL sediment data need to be averaged over three years to determine compliance, then the contaminant concentrations in sediment would be reported in the 2017-2018 annual report when sufficient data to calculate a three-year average are obtained.

4. Los Angeles River Estuary

Monitoring data analyzed include data from 2013 to 2017 submitted by the Lower Los Angeles River Watershed Management (LLAR WMP) Group. The monitoring includes one dry and two wet weather events every year.

4.1 Water Column

The TMDL did not include specific water column numeric targets for Los Angeles River, therefore, water column data were analyzed and compared to the CTR numeric targets for freshwater and saltwater.

Copper, lead, and zinc data are meeting the targets in dry weather. In wet weather, only lead is meeting the target, while copper and zinc are not.

Table 4 Water Column Data Summary (2013-2017) for Los Angeles River Estuary, Wet and Dry Weather, Freshwater Stations

Constituents	Sample Count	Minimum (ug/L)	Maximum (ug/L)	Average (ug/L)	Data Above Target
Wet Weather Total Copper	18	6.06	273	70.0	11
Wet Weather Total Lead	18	0.605	134	38.9	0
Wet Weather Total Zinc	18	32.9	1280	367.1	7
Dry Weather Total Copper	12	6.1	12.6	10.1	0
Dry Weather Total Lead	10	0.723	11.9	2.18	0
Dry Weather Total Zinc	13	25.8	134	55.3	0

4.2 Sediment

Sediment monitoring was conducted for 2015-2016 and 2017-2017 and the data assessment is based on these two years of monitoring data. The 2012 Dominguez Channel and Greater Harbor Waters T MDL assigned interim and final sediment allocations to Los Angeles River estuary. Because compliance assessment with the sediment interim limit can be demonstrated by meeting the interim allocations over a three-year averaging period and because only two years are available, a complete compliance determination cannot be made.

Based on the monitoring data available from the last two years of monitoring, metals and polycyclic aromatic hydrocarbons (PAHs) concentrations in suspended sediment are currently above the interim limits. Total PCBs and DDTs are currently below the interim limits.

Table 5 Sediment Data Summary (2015-2016 and 2016-2017) for Los Angeles River Estuary

Constituents	Sample Count	Minimum (ug/L)	Maximum (ug/L)	Average (ug/L)	Interim Allocation (ug/dry wt)	Sample Count above the Interim
Total Copper	6	22.90	413.0	132.9	53.00	4
Total Lead	5	1.74	288.0	76.56	46.70	2
Total Zinc	6	93.90	1308	476.7	183.5	5
Total PAHs	6	0.270	9.72	5.93	4.36	3
Total PCBs	4	0.13	0.25	0.22	0.68	0
Total DDTs	4	0.020	0.12	0.090	0.25	0

5. San Gabriel River Estuary

The 2012 TMDL did not include numeric targets for the San Gabriel River (the San Gabriel River impairments are addressed by TMDLs developed specifically for the San Gabriel River) but did require monitoring for water column and sediment in the San Gabriel River estuary. The Lower San Gabriel River Watershed Management Group (LSGRWMG) has conducted water and sediment monitoring above the San Gabriel River Estuary to determine the river's contribution to the impairment in the Greater Harbor Waters. The monitoring has been conducted for the last two years for one dry and two wet weather events every year.

5.1 Water Column

Available wet weather data for metals were compared to numeric targets specified in the San Gabriel River Metals TMDL. Monitoring data from San Gabriel River Estuary during wet weather were compared to the total saltwater acute targets converted from saltwater dissolved CTR criteria using CTR saltwater default translators. The data showed exceedances for copper occurred for both sampling events and no exceedances for the other constituents. Dry weather data for saltwater were not available. The saltwater data in the lower San Gabriel River Watershed are summarized in Table 8.

Table 6 Water Column Data Summary (2015-2016 and 2016-2017) for San Gabriel River Estuary, Wet Weather, Saltwater Stations

Constituents	Sample Count	Minimum (ug/L)	Maximum (ug/L)	Average (ug/L)	Saltwater Acute Target (ug/L)	Sample Count above the Target
Total Copper	2	7.41	7.83	7.62	3.73	2
Total Lead	2	2.79	4.07	3.43	8.52	0
Total Zinc	2	37.2	45.2	41.2	85.6	0

5.2 Sediment

The sediment data from 2015-2016 and 2017-2017 were compared to the sediment interim allocations for San Pedro Bay Near/Off Shore Zones.

Compliance with the sediment interim limits can be demonstrated by meeting the interim allocations over a three-year averaging period and because only two years are available, a complete compliance

determination cannot be made. Based on the monitoring data analyzed, all metals, PAHs, PCBs and DDTs concentrations in suspended sediment are above the interim limits.

Table 7 Sediment Data Summary (2015-2016 and 2016-2017) for San Gabriel River Estuary

Constituents	Sample Count	Minimum (ug/L)	Maximum (ug/L)	Average (ug/L)	Interim Allocation (ug/g dry wt)	Sample Count Above the Interim
Total Copper	8	85.2	384	205	76.9	8
Total Lead	8	50.2	175	117	66.6	7
Total Zinc	8	487.0	2620	1312	263.1	8
Total PAHs	8	4.560	15.80	9.206	4.022	8
Total PCBs	8	0.0770	0.305	0.134	0.193	2
Total DDTs	8	0.053	0.10	0.077	0.057	7

6. Greater Los Angeles and Long Beach Harbor Waters

6.1 Water Column

In general, DDT and PCBs were non-detect in water samples except when special low detection methods were used. While DDT and PCBs are still in the water, methods typically used for those compounds are inadequate to measure low concentrations. Copper frequently exceeds the Waste Load Allocations.

While much TMDL-required monitoring did not begin until 2015-2016, water column samples in the Greater Harbor Waters were collected from 2014, both as TMDL required compliance monitoring and as part of special studies being conducted in the Harbor. To fulfill monitoring requirements of the Harbor Toxics TMDL, a Coordinated Compliance Monitoring and Reporting Plan (Harbors CCMRP) was developed and implemented by cooperating parties for the Greater Harbor Waters (Anchor QEA, 2018b). The Harbors CCMRP, which began in 2014, includes water quality monitoring at 22 locations (TMDL compliance monitoring locations), three times per year (two wet events and one dry event).

Water quality monitoring stations included nine locations in the Inner Harbor, four locations in the Outer Harbor, one location each in the Consolidated Slip, Fish Harbor, Cabrillo Marina, and Inner Cabrillo Beach, two locations in the Los Angeles River Estuary, and three locations in Eastern San Pedro Bay. Water quality monitoring included metals, organics, and physical parameters (Anchor QEA, 2015) (Anchor QEA, 2017b) (Anchor QEA, 2018a) (Anchor QEA, 2018c)

Figure 1 Dominguez Channel and Greater Harbor Waters TMDL Compliance Monitoring Locations

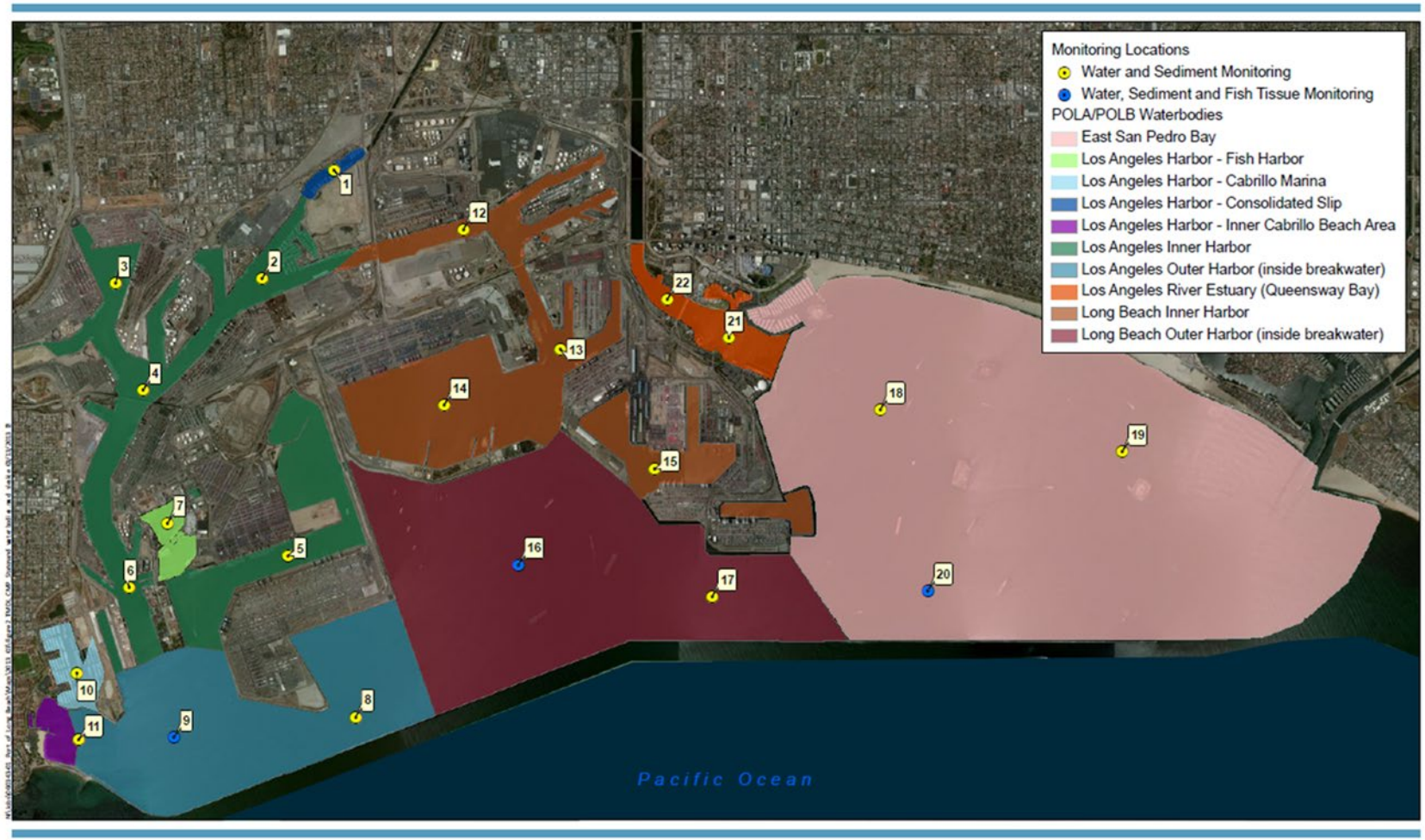

Figure 2
TMDL Compliance Monitoring Locations
Coordinated Compliance Monitoring and Reporting Plan
Greater Los Angeles and Long Beach Harbor Waters

In addition, the Ports' Low Detection Limit Water Column Sampling Program (LDL Study) measured organic concentrations at nine locations in the Harbor (Anchor QEA, 2013b) (Ramboll Environ and Weston, 2015). The LDL Study was conducted in three, one-month phases in 2014 and 2015. Data were collected at eight locations inside the harbor and one location outside of breakwater. Waterbodies sampled included the Inner Harbor, Outer Harbor, Consolidated Slip, Fish Harbor, Los Angeles River Estuary, and East San Pedro Bay.

Water column data in the Greater Harbor are presented in Table 10. These data were compared to the Harbor Toxics TMDL receiving (salt) water column concentration-based final allocations for copper, lead, zinc, DDT, and PCB (RWQCB and U.S. EPA, 2011).

There were 285 samples in total for metals. Total copper concentrations were above the WLA value (3.73 ug/L) at least once in all waterbodies. Of the 60 samples which were above the total copper allocations, 51 occurred during wet events. Four samples above the allocations occurred for total lead; one in Consolidated Slip, two in the Los Angeles River Estuary, and one in East San Pedro Bay. Two samples above the allocations occurred for total zinc; one in Consolidated Slip and one in LA/LB Inner Harbor.

For DDT and PCB, most of 309 samples were below detection limits. Overall, there were 283 and 281 non-detects for DDT and PCB, respectively. The only samples above detection limits were collected as part of the LDL Study. For DDT, two out of 8 detectable DDT concentrations were above the concentration-based allocations in the Los Angeles and Long Beach Inner Harbor and three out of 6 detectable concentrations from East San Pedro Bay. Detectable DDT concentrations in Fish Harbor, Outer Harbor, and Los Angeles River Estuary were below the concentration-based allocations. For PCB, detectable concentrations were above the concentration-based WLAs in the Los Angeles and Long Beach Inner Harbor (6), Los Angeles and Long Beach Outer Harbor (9), Fish Harbor (2), Los Angeles River Estuary (5), and East San Pedro Bay (5).

Table 8 Water Column Data Summary (2014 – 2018) for Greater Harbor Waters, Dry and Wet Weather

TMDL Area Name	Chemical	Sample Count	Min (ug/L)	Max (ug/L)	Avg (ug/L)	No. of Non-detect	Receiving (salt) Water Column Conc.-Based WLAs	Count Detected Above WLAs
East San Pedro Bay	Copper	39	0.31	17.1	1.71	6	3.73	3
East San Pedro Bay	Lead	39	0.039	17.7	0.880	0	8.52	1
East San Pedro Bay	Zinc	39	1.12	35.4	6.78	0	85.6	0
East San Pedro Bay	4,4'-DDT	43	0.000002	0.0020	0.00030	37	0.00059	3
East San Pedro Bay	Total PCB	43	0.00040	0.00080	0.00050	38	0.00017	5
Fish Harbor	Copper	13	2.02	6.98	4.19	2	3.73	10
Fish Harbor	Lead	13	0.075	0.650	0.260	0	8.52	0
Fish Harbor	Zinc	13	9.20	18.8	13.1	0	85.6	0
Fish Harbor	4,4'-DDT	15	0.00000007	0.00040	0.00020	14	0.00059	0
Fish Harbor	Total PCB	15	0.00040	0.0020	0.00060	13	0.00017	2
LA/LB Outer Harbor	Copper	52	0.25	9.07	1.47	8	3.73	2

LA/LB Outer Harbor	Lead	52	0.016	4.32	0.290	3	8.52	0
LA/LB Outer Harbor	Zinc	52	0.390	24.4	5.05	1	85.6	0
LA/LB Outer Harbor	4,4'-DDT	60	0.00000007	0.00050	0.00020	53	0.00059	0
LA/LB Outer Harbor	Total PCB	60	0.00040	0.00090	0.00050	51	0.00017	9
Cabrillo Marina	Copper	13	1.58	69.1	11.0	2	3.73	11
Cabrillo Marina	Lead	13	0.020	0.350	0.120	1	8.52	0
Cabrillo Marina	Zinc	13	10.9-	34.2	22.7	0	85.6	0
Cabrillo Marina	4,4'-DDT	13	0.00020	0.00040	0.00030	13	0.00059	0
Cabrillo Marina	Total PCB	13	0.00040	0.00060	0.00050	13	0.00017	0
Consolidated Slip	Copper	13	1.54	17.9	5.71	2	3.73	6
Consolidated Slip	Lead	13	0.140	11.2	1.66	0	8.52	1
Consolidated Slip	Zinc	13	9.68	91.6	31.0	0	85.6	1
Consolidated Slip	4,4'-DDT	13	0.00020	0.00040	0.00030	13	0.00059	0
Consolidated Slip	Total PCB	13	0.00040	0.00060	0.00050	13	0.00017	0
Inner Cabrillo Beach	Copper	13	1.26	6.15	2.63	2	3.73	2
Inner Cabrillo Beach	Lead	13	0.027	1.26	0.250	0	8.52	0
Inner Cabrillo Beach	Zinc	13	3.52	17.5	7.83	0	85.6	0
Inner Cabrillo Beach	4,4'-DDT	13	0.00020	0.00040	0.00030	13	0.00059	0
Inner Cabrillo Beach	Total PCB	13	0.00040	0.00060	0.00050	13	0.00017	0
LA/LB Inner Harbor	Copper	117	0.37	40.7	2.65	18	3.73	15
LA/LB Inner Harbor	Lead	117	0.024	4.49	0.290	5	8.52	0
LA/LB Inner Harbor	Zinc	117	1.27	86.7	9.87	0	85.6	1
LA/LB Inner Harbor	4,4'-DDT	123	0.000002	0.0027	0.00030	115	0.00059	2
LA/LB Inner Harbor	Total PCB	123	0.00040	0.0042	0.00060	116	0.00017	6
LA River Estuary	Copper	25	0.87	34.6	6.29	4	3.73	11
LA River Estuary	Lead	25	0.25	45.1	4.23	0	8.52	2
LA River Estuary	Zinc	25	5.69	84.3	24.6	0	85.6	0
LA River Estuary	4,4'-DDT	29	0.000004	0.00040	0.00020	25	0.00059	0
LA River Estuary	Total PCB	29	0.00040	0.0020	0.00070	24	0.00017	5

Data sources: Anchor QEA 2013b, 2015, 2017b, 2018a, and 2018e; Ramboll Environ and Weston 2015.

6.2 Sediment

In general, sediments in the Greater Harbor Waters are contaminated. Metals and chlorinated hydrocarbons frequently exceed targets. There are fewer, but still some, exceedances of PAHs.

The sediment assessment for Greater Harbors Waters will be discussed in the following three sub-sections. The first sub-section reviews sediment chemistry data compared to the sediment targets established in the TMDL which include targets derived from sediment guidelines and targets derived from fish contaminant goal (FCG)-associated sediment targets as reviewed in Section 2.3. The second sub-section reviews the SQO assessment for benthic community protection and the third subsection reviews the SQO assessment for human health protection using the SQO guidance provided in Section 3 of the Staff Report.

6.2.1 Sediment Chemistry

Sediment data from the Greater Harbor Waters used for this assessment was collected from 2012 to 2018 as part of special studies and TMDL compliance monitoring. Data sources included:

- The 2013 Regional Marine Monitoring Program (Bight' 13), which included 44 monitoring locations in the Greater Harbor Waters (SCCWRP, April 2016).

- Several special studies conducted by the Ports which collected sediment data throughout the Greater Harbor Waters (Anchor QEA, 2012) (Weston, 2013) (Environ, 2015) (Ramboll Environ and Weston, 2015).
- Sediment monitoring for TMDL compliance required twice per 5-year period, which occurred in 2016 and 2018.
- Sediment chemistry samples collected at the 22 TMDL compliance monitoring locations that include all TMDL waterbodies in the Greater Harbor Waters (Anchor QEA, 2018a) (Anchor QEA, 2018c).

Sediment data are summarized by TMDL waterbody in Table 9. In this table, these data are compared to the marine benthic health sediment target (the marine benthic health target is the Effects Range Low (ERL) guideline developed by the National Oceanographic and Atmospheric Administration (NOAA) and the FCG-associated sediment target determined in the 2012 DC and Greater Harbor Waters TMDL). Metals are listed for the Los Angeles and Long Beach Inner Harbor, Consolidated Slip, and Fish Harbor. For these three waterbodies, copper was above the target in 44 out of 48 samples, lead in 12 out of 15 samples, and zinc in 25 out of 48 samples. Cadmium, chromium, and mercury were above the sediment targets in at least one sample in Consolidated Slip.

Multiple individual PAHs were above the respective marine benthic health sediment targets that are listed for the Los Angeles and Long Beach Inner Harbor, Consolidated Slip, Fish Harbor, and Cabrillo Marina. Four samples above the target occurred in Consolidated Slip and Fish Harbor for benzo(a)anthracene. For benzo(a)pyrene, five samples above the target occurred in the Los Angeles and Long Beach Inner Harbor, Consolidated Slip, and Fish Harbor and none in Cabrillo Marina. Six samples for chrysene were found above the target in the Los Angeles and Long Beach Inner Harbor, Consolidated Slip, and Fish Harbor. One sample for pyrene and phenanthrene in Consolidated Slip and one sample for dibenzo(a,h)anthracene in Fish Harbor were above the targets. In Consolidated Slip, all samples for 2-methylnaphthalene were below the target. For chlorinated hydrocarbons (DDT, PCBs, chlordane, dieldrin and toxaphene), sediments were above the marine sediment targets and FCG-associated sediment targets in all the eight waterbodies. DDT and PCB were observed in high concentrations in the sediments of all eight waterbodies. For DDT, out of 150 samples, 129 samples were above the marine benthic health sediment target and 126 were above the FCG associated sediment target. For PCB, out of 150 samples, 85 samples were above the marine benthic health sediment target and 118 samples were above the FCG associated sediment target.

Chlordane is included on the 303(d) list in four waterbodies – Consolidated Slip, Fish Harbor, Los Angeles River Estuary, and East San Pedro Bay and 27 samples in this data review were above the marine sediment target and 18 samples were above the FCG-associated sediment target. All samples were above the chlordane targets in Consolidated Slip and Los Angeles River Estuary. For Fish Harbor, all 17 chlordane samples were non-detects. In East San Pedro Bay, 12 of 19 chlordane samples were non-detects.

Dieldrin and toxaphene are included in the 303(d) list in Consolidated Slip. All dieldrin samples were above the marine benthic health sediment target and two samples for toxaphene were above both marine sediment targets and FCG associated sediment targets.

Table 9 Sediment Data (2012 – 2018) for Greater Harbor Waters

TMDL Area Name	Chemical Name	Sample Count	Min	Max	Ave	No. of Non-detect	Marine Sediment Target	Marine Sediment Target Exceedance Count	FCG-Associated Sediment Target	Above FCG Target Count	Units
East San Pedro Bay	Total PCB (U = 0)	23	0.14	206.	42.8	2	22.7	8	3.2	19	ug/kg
East San Pedro Bay	Total DDT (U = 0)	23	0.07	53.1	19.3	1	1.58	21	1.9	21	ug/kg
East San Pedro Bay	Chlordane	19	0.055	5.2	0.96	12	0.50	12	1.3	4	ug/kg
Fish Harbor	Copper	12	66.1	717	235	0	34.0	12	-	-	mg/kg
Fish Harbor	Lead	12	19.0	127	66.9	0	46.7	9	-	-	mg/kg
Fish Harbor	Zinc	12	83.2	589	282	0	150	11	-	-	mg/kg
Fish Harbor	Mercury	12	0.29	2.6	1.1	0	0.15	12	-	-	mg/kg
Fish Harbor	Benzo(a)anthracene	12	63.00	1102	245.9	0	261.0	2	-	-	ug/kg
Fish Harbor	Benzo(a)pyrene	12	84.50	2500	440.4	0	430.0	2	-	-	ug/kg
Fish Harbor	Chrysene	12	99.00	1827	412.0	0	384.0	2	-	-	ug/kg
Fish Harbor	Pyrene	12	90.2	610	212	0	665	0	-	-	ug/kg
Fish Harbor	Phenanthrene	12	44.1	240	98.5	0	240	0	-	-	ug/kg
Fish Harbor	Dibenzo(a,h)anthracene	12	15.2	700	87.7	0	260	1	-	-	ug/kg
Fish Harbor	Total PCB (U = 0)	17	6.10	812	148	0	22.7	9	3.2	17	ug/kg
Fish Harbor	Total DDT (U = 0)	17	5.40	285	79.7	0	1.58	17	1.9	17	ug/kg
Fish Harbor	Chlordane	12	0.03	1	0.5	12	0.5	1	1.3	0	ug/kg

TMDL Area Name	Chemical Name	Sample Count	Min	Max	Ave	No. of Non-detect	Marine Sediment Target	Marine Sediment Target Exceedance Count	FCG-Associated Sediment Target	Above FCG Target Count	Units
LA/LB Inner Harbor	Copper	33	8.97	259	75.7	0	34.0	29	-	-	mg/kg
LA/LB Inner Harbor	Zinc	33	21.5	401	149	0	150	11	-	-	mg/kg
LA/LB Inner Harbor	Benzo(a)pyrene	33	2.50	1400	162	1	430.0	2	-	-	ug/kg
LA/LB Inner Harbor	Chrysene	33	2.80	1200	120.9	0	384.0	2	-	-	ug/kg
LA/LB Inner Harbor	Total PCB (U = 0)	48	0.05	767	85.4	8	22.7	29	3.2	36	ug/kg
LA/LB Inner Harbor	Total DDT (U = 0)	48	0.03	113	25.7	2	1.58	37	1.9	36	ug/kg
LA/LB Outer Harbor	Total PCB (U = 0)	38	0.05	80.1	21.2	10	22.7	19	3.2	24	ug/kg
LA/LB Outer Harbor	Total DDT (U = 0)	38	0.60	136	30.6	0	1.58	30	1.9	29	ug/kg
LA Harbor Cabrillo Marina	Benzo(a)pyrene	3	27.6	340	232	0	430	0	-	-	ug/kg
LA Harbor Cabrillo Marina	Total PCB (U = 0)	3	10.4	101	55.1	0	22.7	2	3.2	3	ug/kg
LA Harbor Cabrillo Marina	Total DDT (U = 0)	3	3.10	61.4	40.0	0	1.58	3	1.9	3	ug/kg
LA Harbor Consolidated Slip	Cadmium	3	1.0	2.2	1.5	0	1.2	1	-	-	mg/kg
LA Harbor Consolidated Slip	Chromium	3	69.8	125	89.3	0	81.0	1	-	-	mg/kg
LA Harbor Consolidated Slip	Copper	3	171	242	199	0	34.0	3	-	-	mg/kg
LA Harbor Consolidated Slip	Mercury	3	0.36	0.62	0.48	0	0.15	3	-	-	mg/kg
LA Harbor Consolidated Slip	Lead	3	95.9	150	114	0	46.7	3	-	-	mg/kg

TMDL Area Name	Chemical Name	Sample Count	Min	Max	Ave	No. of Non-detect	Marine Sediment Target	Marine Sediment Target Exceedance Count	FCG-Associated Sediment Target	Above FCG Target Count	Units
LA Harbor Consolidated Slip	Zinc	3	450	746	554	0	150	3	-	-	mg/kg
LA Harbor Consolidated Slip	Benzo(a)anthracene	3	108	620	339	0	261	2	-	-	ug/kg
LA Harbor Consolidated Slip	Benzo(a)pyrene	3	150	750	437	0	430	1	-	-	ug/kg
LA Harbor Consolidated Slip	Chrysene	3	172.6	1100	597.5	0	384.0	2	-	-	ug/kg
LA Harbor Consolidated Slip	Pyrene	3	229.2	1200	686.4	0	665.0	1	-	-	ug/kg
LA Harbor Consolidated Slip	Phenanthrene	3	70.8	330	200	0	240	1	-	-	ug/kg
LA Harbor Consolidated Slip	2-Methylnaphthalene	3	6.60	29.5	21.4	1	201	0	-	-	ug/kg
LA Harbor Consolidated Slip	Total PCB (U = 0)	12	13.80	1531	532.4	0	22.70	11	3.2	12	ug/kg
LA Harbor Consolidated Slip	Total DDT (U = 0)	12	15.7	279	145	0	1.58	12	1.9	12	ug/kg
LA Harbor Consolidated Slip	Chlordane	9	4.1	47	21	0	0.50	9	1.3	9	ug/kg
LA Harbor Consolidated Slip	Dieldrin	9	0.03	0.7	0.4	9	0.02	9	-	-	ug/kg
LA Harbor Consolidated Slip	Toxaphene	3	0.05	12	7.7	3	0.10	2	0.1	2	ug/kg
LA Harbor Inner Cabrillo Beach	Total PCB (U = 0)	4	0.05	48.9	31.1	1	22.7	3	3.2	3	ug/kg
LA Harbor Inner Cabrillo Beach	Total DDT (U = 0)	4	2.20	51.9	28.0	0	1.58	4	1.9	4	ug/kg
LA River Estuary (Queensway Bay)	Total PCB (U = 0)	5	1.51	106	59.3	0	22.7	4	3.2	4	ug/kg

TMDL Area Name	Chemical Name	Sample Count	Min	Max	Ave	No. of Non-detect	Marine Sediment Target	Marine Sediment Target Exceedance Count	FCG-Associated Sediment Target	Above FCG Target Count	Units
LA River Estuary (Queensway Bay)	Total DDT (U = 0)	5	1.90	22.0	14.1	0	1.58	5	1.9	4	ug/kg
LA River Estuary (Queensway Bay)	Chlordane	5	2.5	11	7.1	0	0.50	5	1.3	5	ug/kg

Notes:

- Total chlordane is the sum of alpha-chlordane, beta-chlordane, gamma-chlordane, cis-nonachlor, trans-nonachlor, and oxychlordane.
- Total DDT is the sum of 4,4'-DDD, 4,4'-DDE, 4,4'-DDT 2,4'-DDD, 2,4'-DDE, and 2,4'-DDT, if measured.
- Total PCB congeners is the sum of all PCB congeners reported in the annual monitoring.
- U: compound analyzed but not detected above detection limit
- Totals (U=0) are calculated as the sum of all detected results. If all results are not detected, half of the highest reporting limit value is reported as the sum.
- ug/L: microgram per liter

6.2.2 Benthic Community Assessment

Much of the Greater Harbor Waters meets the benthic community SQO with the exception of Fish Harbor, Consolidated Slip, and Eastern San Pedro Bay.

The benthic community assessment was performed for the Greater Harbor Waters using the methods provided in the SQPs. A detailed description of the benthic community assessment for the Greater Harbor Waters is included in the Sediment Quality Objectives for Benthic Health: Area-Impacted Analysis and Compliance Assessment memorandum submitted by Anchor QEA, LLC., and Latitude Environmental, Inc. for the Port of Los Angeles and the Port of Long Beach (Anchor QEA, LLC. and Latitude Environmental, Inc., 2018b)

The benthic community assessments presented in this section were conducted with data collected for the Bight 13 program and the 2014/15 monitoring. A description of the methods applied to perform an area-impacted analysis is provided in Section 3.2 of the Staff Report and summarized below.

Assessment Units

Per Section 3.2, the functional approach option was selected for assessment unit boundaries for the Greater Harbor Waters. Nine assessment units incorporate one or more TMDL-defined waterbodies. These assessment units are shown in Figure 2 and include the following:

- Dominguez Channel Estuary
- Consolidated Slip
- Fish Harbor
- Los Angeles Inner Harbor (including Cabrillo Marina)
- Los Angeles Outer Harbor (including Inner Cabrillo Beach)
- Long Beach Inner Harbor
- Long Beach Outer Harbor
- Eastern San Pedro Bay
- Los Angeles River Estuary (Queensway Bay)

Each assessment unit included samples that were taken from randomly selected stations.

Benthic Community Assessment Results

The benthic assessment of the Greater Harbor Waters included samples taken from 64 sampling stations. Table 10 provides a summary of each station, its SQO score, and the area (in acres) it represents. Sixteen Stations were assessed as Possibly Impacted or Likely Impacted. None of the sampled stations were assessed as Clearly Impacted.

An assessment unit meets the protective condition when at least 85% of the area is Likely Unimpacted and Unimpacted as established in the SQPs and Attachment A. Los Angeles Inner Harbor, Los Angeles Outer Harbor, Long Beach Inner Harbor, Long Beach Outer Harbor, and Los Angeles River Estuary currently meet the 85% threshold. Fish Harbor, Consolidated Slip, and Eastern San Pedro Bay do not meet the 85% threshold.

Figure 2 2013 Benthic Community SQO Assessment

Figure 3 Benthic Community SQO Assessment Using Thiessen Polygon Area-Weighted Assessment

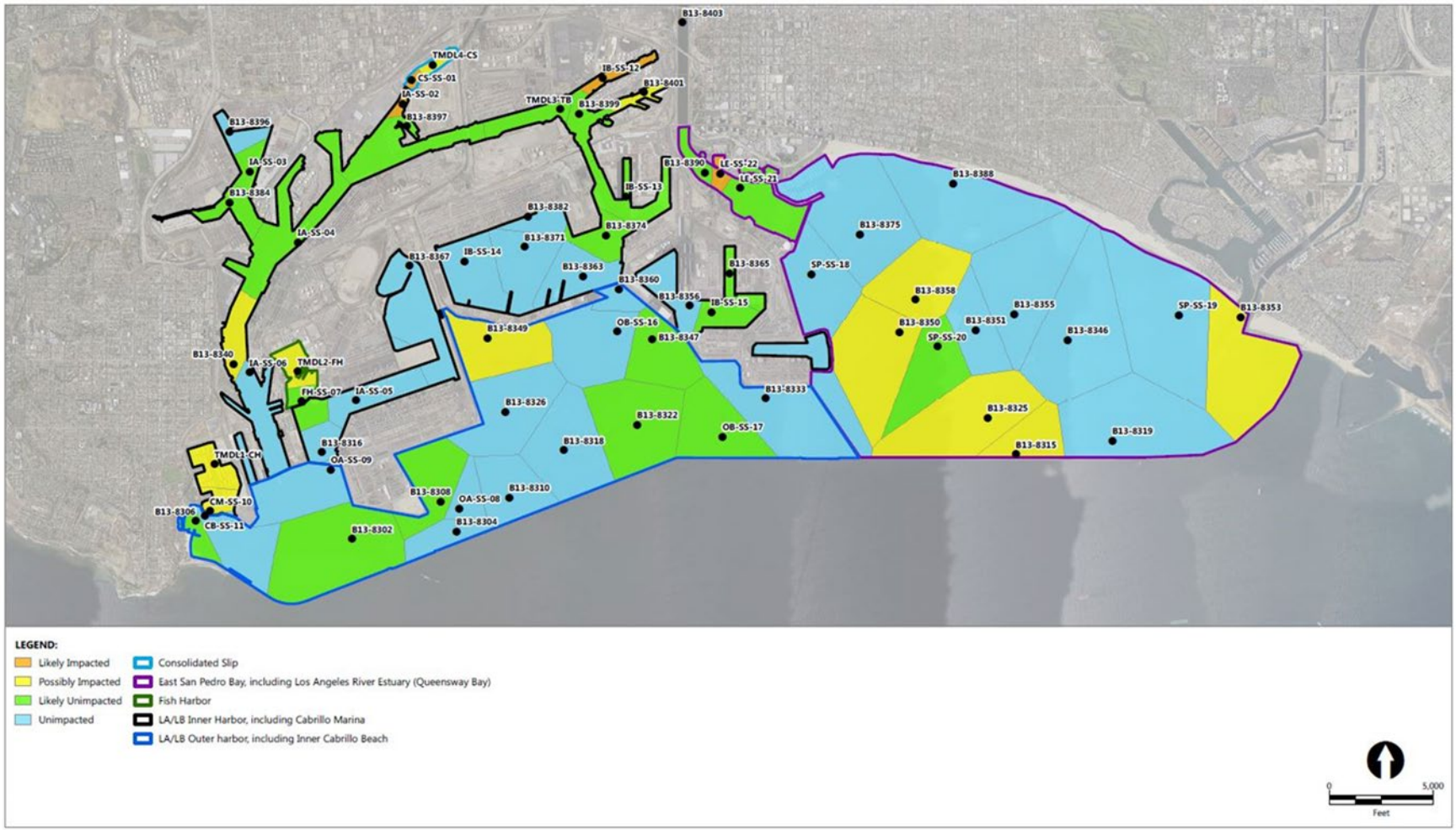

Table 10 Benthic Community SQO Assessment Analysis

TMDL Waterbody	Station Identification	Acres	Integrated Score
Eastern San Pedro Bay	SP-SS-20	249	Likely unimpacted
Eastern San Pedro Bay	B13-8315	153	Possibly impacted
Eastern San Pedro Bay	B13-8325	460	Possibly impacted
Eastern San Pedro Bay	B13-8350	426	Possibly impacted
Eastern San Pedro Bay	B13-8353	447	Possibly impacted
Eastern San Pedro Bay	B13-8358	297	Possibly impacted
Eastern San Pedro Bay	B13-8319	559	Unimpacted
Eastern San Pedro Bay	B13-8333	74	Unimpacted
Eastern San Pedro Bay	B13-8333	113	Unimpacted
Eastern San Pedro Bay	B13-8346	586	Unimpacted
Eastern San Pedro Bay	B13-8351	200	Unimpacted
Eastern San Pedro Bay	B13-8355	503	Unimpacted
Eastern San Pedro Bay	B13-8375	555	Unimpacted
Eastern San Pedro Bay	B13-8388	514	Unimpacted
Eastern San Pedro Bay	SP-SS-18	284	Unimpacted
Eastern San Pedro Bay	SP-SS-19	628	Unimpacted
LA/LB Inner Harbor	IB-SS-12	42	Likely impacted
LA/LB Inner Harbor	B13-8374	99	Likely unimpacted
LA/LB Inner Harbor	B13-8397	38	Likely unimpacted
LA/LB Inner Harbor	B13-8399	77	Likely unimpacted
LA/LB Inner Harbor	IB-SS-13	131	Likely unimpacted
LA/LB Inner Harbor	TMDL3-TB	84	Likely unimpacted
LA/LB Inner Harbor	B13-8401	35	Possibly impacted
LA/LB Inner Harbor	B13-8363	167	Unimpacted
LA/LB Inner Harbor	B13-8371	212	Unimpacted

TMDL Waterbody	Station Identification	Acres	Integrated Score
LA/LB Inner Harbor	B13-8382	66	Unimpacted
LA/LB Inner Harbor	IB-SS-14	205	Unimpacted
Los Angeles River Estuary (Queensway Bay)	LE-SS-22	25	Likely impacted
Los Angeles River Estuary (Queensway Bay)	B13-8390	45	Likely unimpacted
Los Angeles River Estuary (Queensway Bay)	LE-SS-21	175	Likely unimpacted
LA/LB Outer Harbor	B13-8322	386	Likely unimpacted
LA/LB Outer Harbor	B13-8347	215	Likely unimpacted
LA/LB Outer Harbor	B13-8365	48	Likely unimpacted
LA/LB Outer Harbor	IB-SS-15	82	Likely unimpacted
LA/LB Outer Harbor	OB-SS-17	263	Likely unimpacted
LA/LB Outer Harbor	B13-8349	253	Possibly impacted
LA/LB Outer Harbor	B13-8310	131	Unimpacted
LA/LB Outer Harbor	B13-8318	350	Unimpacted
LA/LB Outer Harbor	B13-8326	300	Unimpacted
LA/LB Outer Harbor	B13-8333	378	Unimpacted
LA/LB Outer Harbor	B13-8356	123	Unimpacted
LA/LB Outer Harbor	B13-8360	52	Unimpacted
LA/LB Outer Harbor	OB-SS-16	305	Unimpacted
Cabrillo Marina	CM-SS-10	42	Possibly impacted
Cabrillo Marina	TMDL1-CH	79	Possibly impacted
Inner Harbor	IA-SS-02	15	Likely impacted
Inner Harbor	B13-8340	96	Possibly impacted
Inner Harbor	B13-8384	87	Likely unimpacted
Inner Harbor	B13-8397	200	Likely unimpacted

TMDL Waterbody	Station Identification	Acres	Integrated Score
Inner Harbor	IA-SS-03	53	Likely unimpacted
Inner Harbor	IA-SS-04	246	Likely unimpacted
Inner Harbor	B13-8316	69	Unimpacted
Inner Harbor	B13-8367	266	Unimpacted
Inner Harbor	B13-8396	54	Unimpacted
Inner Harbor	IA-SS-05	141	Unimpacted
Inner Harbor	IA-SS-06	168	Unimpacted
Inner Harbor	OA-SS-09	5	Unimpacted
Inner Harbor	OA-SS-09	22	Unimpacted
Outer Harbor	B13-8302	519	Likely unimpacted
Outer Harbor	B13-8306	57	Likely unimpacted
Outer Harbor	B13-8308	219	Likely unimpacted
Outer Harbor	B13-8304	99	Unimpacted
Outer Harbor	B13-8310	80	Unimpacted
Outer Harbor	B13-8326	42	Unimpacted
Outer Harbor	CB-SS-11	204	Unimpacted
Outer Harbor	OA-SS-08	86	Unimpacted
Outer Harbor	OA-SS-09	230	Unimpacted
Consolidated Slip	CS-SS-01	14	Likely impacted
Consolidated Slip	TMDL4-CS	24	Possibly impacted
Fish Harbor	FH-SS-07	71	Likely unimpacted

Table 11 Area Impacted Analysis

Assessment Unit	Total Acres	SQO Area Meeting Protective Condition (acres)	% Area Meeting Protective Condition
Eastern San Pedro Bay	6048	4266	71%
Long Beach Inner Harbor	1156	1080	93%
Los Angeles River Estuary (Queensway Bay)	246	221	90%
Long Beach Outer Harbor	2885	2632	91%
Los Angeles Inner Harbor	1544	1312	85%
Los Angeles Outer Harbor	1535	1535	100%
Consolidated Slip	38	0	0%
Fish Harbor	133	71	54%

6.2.3 Human Health Assessment

In general, while fish tissue remains above Fish Contaminant Goal guidelines, Greater Harbor Waters sediments meet the human health SQOs for DDT and for PCBs in most Fish Movement Zones (FMZ) including Los Angeles Inner Harbor, Seaplane Lagoon, Los Angeles Outer Harbor, Long Beach Inner Harbor North, Long Beach Inner Harbor South, and Long Beach Outer Harbor. Consolidated Slip and Eastern San Pedro Bay do not meet the human health SQOs for PCBs.

The human health assessment was performed using the methods provided in Section 3.3 and the SQPs. The human health assessment process for the Greater Harbor Waters included a three-tiered site assessment process for evaluating whether site sediments are at a condition that is protective of human consumers of locally caught seafood. All three-tiered assessment methods involve integration of chemical exposure and sediment linkage to fish. The results of the three-tiered human health assessment are discussed below.

6.2.3.1 Tier I Assessment

The Tier I assessment was conducted at four assessment areas defined by the compliance monitoring program: Consolidated Slip, Los Angeles Outer Harbor, Long Beach Outer Harbor, and Eastern San Pedro Bay. Sediment data used in the assessment were collected in 2013 and 2014 (Anchor QEA, 2015); (SCCWRP, 2016), and fish tissue was collected in 2014 (Anchor QEA, 2015) (Amec Foster Wheeler, 2016). Data used in the assessment included 40 polychlorinated biphenyl (PCB) congeners, total of the six derivatives of DDT (2,4'-DDD, 2,4'-DDE, 2,4'-DDT, 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT), five components of total chlordane (chlordane, alpha; chlordane, gamma-; nonachlor, cis-; nonachlor, trans-; and oxychlordane), and dieldrin. A separate assessment was conducted for each contaminant group (PCBs, DDTs, chlordanes, or dieldrin).

Fish tissue concentrations were compared to SQO Tier I screening thresholds. If the average tissue concentration of all measured species exceeded the screening threshold, there is the potential for unacceptable chemical exposure and a Tier II evaluation is required. If the tissue concentration is equal to or less than the tissue screening threshold, the chemical exposure is acceptable, and the site is assessed as Unimpacted.

The 95% upper confidence limit (UCL) for sediment concentrations in each area were compared to sediment screening thresholds. Screening thresholds were calculated from a biota-sediment accumulation factor (BSAF). The technical guidance document for the SQPs provides BSAF lookup tables for each dietary guild of fish (Table 3.2 in SCCWRP 2017a). The calculated sediment values are compared to the 95% UCL for each contaminant. If the 95% UCL value is higher than the BSAF calculated threshold value, there is the potential for unacceptable chemical exposure and a Tier II evaluation is required. If the 95% UCL value is equal to or less than the BSAF screening threshold, the chemical exposure is acceptable, and the site is assessed as Unimpacted.

The Tier I assessment for each of the four areas is summarized in Table 12. Data input summaries for each assessment area are provided in the Human Health Sediment Quality Objectives: Compliance Assessment Memorandum (Anchor QEA and Latitude Environmental, 2018a).

Table 12 Overall Assessment for Tier I for Each Area Evaluated

Assessment Area	DDT	PCBs	Chlordane	Dieldrin
LA Outer Harbor	Unimpacted	Tier 2 assessment needed	Unimpacted	Unimpacted
LB Outer Harbor	Unimpacted	Tier 2 assessment needed	Unimpacted	Unimpacted
Consolidated Slip	Tier 2 assessment needed	Tier 2 assessment needed	Unimpacted	Unimpacted
Eastern San Pedro Bay	Unimpacted	Tier 2 assessment needed	Unimpacted	Unimpacted

6.2.3.2 Tier II Assessment

The Tier II assessment was applied to the three assessment units: Los Angeles Outer Harbor, Long Beach Outer Harbor, and Eastern San Pedro Bay (Anchor QEA, 2014a). The assessment was not conducted on Consolidated Slip because the size of the site is less than 1 square kilometer and, per the SQP, too small for Tier II assessment. A Tier III assessment was conducted for all areas including Consolidated Slip and is described in detail in the next section.

The Tier II assessment was conducted in 2015 using available data collected between 2010 and 2014.

The assessment was performed using a bioaccumulation model incorporated into a Microsoft Excel-based model called the Decision Support Tool for Tier II assessments (SCCWRP, 2017). This Decision Support Tool was used to evaluate the indirect effects of sediment contamination in four areas listed above where sediment and fish tissue data were available. Because the Tier I assessment found Unimpacted sediment quality conditions for dieldrin and total chlordane in all assessment areas, those analytes were dropped from the Tier II assessment. The Decision Support Tool inputs included PCB congeners and DDT in sediment and fish tissue quality data, site-specific parameters (area size and maximum length of the site), and the following abiotic factors: dissolved oxygen (DO), temperature, salinity, dissolved organic carbon (DOC), particulate organic carbon (POC), and total suspended solid (TSS) concentration. Information concerning the specific development and function of modeling steps within the Decision Support Tool is available in the user's guide.

Consumption risk results and sediment linkage results were categorized in accordance with the SQP Plan Tier II effects assessment (SWRCB, 2018). Site sediments categorized as Unimpacted or Likely Unimpacted meet the sediment quality condition that is protective of the beneficial uses for the specific contaminants evaluated. Sediments categorized as Possibly Impacted, Likely Impacted, or Clearly Impacted do not meet the sediment quality condition protective of beneficial uses. Each chemical contaminant group is analyzed separately to determine if it meets the SQO.

The Tier II assessment results are shown in Table 13 for each area. Model input and output summaries for each assessment area are provided in Attachment A. These results were based on the individual lines

of evidence that included consumption risk and sediment linkage for each assessment area. The final assessment category for DDT was Likely Unimpacted for all areas. The final assessment category for PCBs was Likely Impacted or Clearly Impacted for all areas.

Table 13 Overall Assessment for Each Area Evaluated

Assessment Area	DDT	PCBs
Los Angeles Outer Harbor	Likely Unimpacted	Likely Impacted
Long Beach Outer Harbor	Likely Unimpacted	Clearly Impacted
Eastern San Pedro Bay	Likely Unimpacted	Clearly Impacted

6.2.3.3 Tier III Assessment

The Tier III site assessment approach summarized here and detailed in Human Health Sediment Quality Objective Tier III Assessment Under Current and Future Conditions (Anchor QEA and Latitude Environmental, 2018a) followed the evaluation framework established in the SQPs. The Tier III site assessment uses a site-specific bioaccumulation model developed for the Harbor to quantify the contribution of sediment and other sources of contaminants to fish tissue concentrations and then integrates those findings with an evaluation of chemical exposure of human seafood consumers.

The site-specific bioaccumulation model was peer reviewed by a group of nationally recognized scientists and modelers, approved by the Los Angeles Water Board, and determined to be acceptable for use in evaluating the sediment-fish contaminant linkage in the Harbor (Arnot, 2016) (Bridges, T.S., 2016a) (Bridges, T.S., 2016b). Tier III Assessment Units were determined by using Fish Movement Zones (FMZ) as described in Section 3.2.3 of the Staff Report

i. Sediment Linkage Determination

The sediment linkage is estimated by running the site-specific bioaccumulation model with two different sediment conditions, one with current elevated levels and one with reduced (TMDL target) levels. The difference in predicted fish tissue concentrations between the two model runs is then calculated. The concentration difference represents the sediment contribution to the fish. Thus, stronger linkage between sediment and fish tissue is indicated by a greater difference in predicted fish tissue concentrations between these two model simulations. This analysis is completed for each individual fish species separately and then averaged to estimate a market basket[1] sediment linkage. The analysis was performed for each FMZ. A sediment linkage category was assigned by determining the portion of the data distribution that was less than (or more than) the sediment linkage threshold as described in the SQPs.

ii. Chemical Exposure

In accordance with SQPs, chemical exposure (associated with human consumption of fish) was determined by calculating the weighted-average contaminant concentration in fish tissue within each FMZ separately and then comparing these values to the Tier II Tissue Contaminant

[1] For Greater Harbor Waters, the market basket included the weighted-average of three representative fish species: white croaker, California halibut, and surfperches

Thresholds in Table 19 of the SQP. The fish tissue PCB and DDT data used to determine chemical exposure were collected between 2002 and 2016 (Anchor QEA, 2017a) (Anchor QEA, 2017b).

iii. Tier III Assessment Findings

Table 14 provides a summary of the integrated assessment results for total PCBs and total DDT by individual FMZ. Site sediments categorized as Unimpacted or Likely Unimpacted meet the human health SQO and protect human consumers for the specific evaluated contaminant. Sediments categorized as Possibly Impacted, Likely Impacted, or Clearly Impacted do not meet the Human Health SQO.

Table 14 Tier III Assessment Results Under Current Conditions

FMZ	Chemical Exposure Category for Total PCBs	Sediment Linkage Category for Total PCBs	Site Assessment for Total PCBs	Chemical Exposure Category for Total DDT	Sediment Linkage Category for Total DDT	Site Assessment for Total DDT
Consolidated Slip	Very High	Low	**Likely Impacted**	Low	Very Low	Unimpacted
LA Inner Harbor	High	Very Low	Likely Unimpacted	High	Very Low	Likely Unimpacted
Fish Harbor	Very High	High	**Clearly Impacted**	Low	Very Low	Unimpacted
Seaplane Lagoon	High	Very Low	Likely Unimpacted	Low	Very Low	Unimpacted
LA Outer Harbor	Moderate	Very Low	Likely Unimpacted	Low	Very Low	Unimpacted
LB Inner Harbor – North	High	Very Low	Likely Unimpacted	Low	Very Low	Unimpacted
LB Inner Harbor – South	High	Very Low	Likely Unimpacted	Low	Very Low	Unimpacted
LB Outer Harbor	Moderate	Very Low	Likely Unimpacted	Low	Very Low	Unimpacted
Eastern San Pedro Bay	High	Moderate	**Likely Impacted**	Low	Very Low	Unimpacted

For PCBs, the site assessment for many FMZs—including Los Angeles Inner Harbor, Seaplane Lagoon, Los Angeles Outer Harbor, Long Beach Inner Harbor North, Long Beach Inner Harbor South, and Long Beach Outer Harbor—was Likely Unimpacted, indicating that these FMZs meet the human health SQO. In these FMZs, the chemical exposure was Moderate to High, but there was Very Low sediment linkage, suggesting that sediment PCB concentrations from each FMZ are not the only contributor to fish PCB body burdens.

The site assessment results for Consolidated Slip and Eastern San Pedro Bay was Likely Impacted for PCBs. In these two areas, the chemical exposure result was High (Eastern San Pedro Bay) to Very High (Consolidated Slip), and the sediment linkage was Low (Consolidated Slip) to Moderate (Eastern San Pedro Bay), indicating a potential relationship between site sediment PCB levels and those in fish.

The site assessment for Fish Harbor was Clearly Impacted for PCBs, which was driven by a Very High chemical exposure and a High sediment linkage. These findings indicate that there is likely a strong relationship between sediment PCB concentrations and those in fish inhabiting this FMZ.

For DDT, the site assessment for all FMZs, except LA Inner Harbor, was Unimpacted, indicating that these FMZs meet the human health SQO for DDT. In these FMZs, the chemical exposure was Low and the sediment linkage was Very Low or Low. For LA Inner Harbor, the site assessment for DDT was Likely Unimpacted, indicating that this FMZ also meets the human health SQO for DDT. The slightly higher categorical result for this FMZ was driven by the High chemical exposure; the sediment linkage was Very Low.

6.4 Fish Tissue

Fish tissue data of TMDL contaminants in the Greater Harbor are provided in Table 15 for 2014 and Table 16 for 2016. The fish tissue data were compared to the FCG and ATL3 fish tissue targets.

The fish tissue data are summarized by year to allow comparison of average tissue concentration over time. In all cases except chlordane in East San Pedro Bay and chlordane in Consolidated Slip, measured fish tissue concentrations were less in 2016 than 2014. Waterbodies sampled for fish include the Outer Harbor, Consolidated Slip, and East San Pedro Bay. In 2014, fish tissue data were collected from the Ports' food web sampling program (Amec Foster Wheeler, 2016) and the TMDL compliance monitoring (Anchor QEA, 2015). Fish tissue sampling for TMDL compliance occurs once every two years at four areas: Los Angeles Outer Harbor, Long Beach Outer Harbor, Consolidated Slip, and East San Pedro Bay (Anchor QEA, 2018b). Fish tissue data from 2016 were from the TMDL compliance monitoring (Anchor QEA, 2018a).

Table 15 Fish Tissue Data (2014) for Greater Harbor Area

Sample Area	Chemical (µg/kg wet)	Sample Count (a)	Min Conc. (a)	Max Conc. (a)	Avg Conc. (a)	ND Sample Count (a)	Sample Count (b)	Min Conc. (b)	Max Conc. (b)	Avg Conc. (b)	ND Sample Count (b)	Sample Count (c)	Min Conc. (c)	Max Conc. (c)	Avg Conc. (c)	ND Sample Count (c)
LA Outer	Chlordane	3	1.42	1.69	1.59	--	3	0.540	1.42	0.890	--	3	0.120	1.15	0.470	--
LA Outer	Dieldrin	3	0.05	0.05	0.05	3	3	0.05	0.05	0.05	3	3	0.05	0.05	0.05	3
LA Outer	Total DDx	13	19.5	494	128	--	12	40.3	314	164	--	13	1.40	50.2	8.93	--
LA Outer	Total PCBs	13	31.0	129	65.8	--	12	35.1	444	114	--	13	5.68	16.3	11.7	--
LA Outer	Toxaphene	3	0.31	0.31	0.31	3	3	0.31	0.31	0.31	3	3	0.31	0.31	0.31	3
LB Outer	Chlordane	3	1.28	1.73	1.49	--	3	1.50	3.00	2.39	--	3	0.05	0.42	0.25	--
LB Outer	Dieldrin	3	0.05	0.05	0.05	3	3	0.05	0.05	0.05	3	3	0.05	0.05	0.05	3
LB Outer	Total DDx	3	122	214	168	--	3	89.2	178	145	--	3	6.69	16.2	10.3	--
LB Outer	Total PCBs	3	104	135	122	--	3	86.3	229	142	--	3	11.5	17.0	13.4	--
LB Outer	Toxaphene	3	0.31	0.31	0.31	3	3	0.31	0.31	0.31	3	3	0.31	0.31	0.31	3
East San Pedro Bay	Chlordane	3	4.88	8.90	7.26	--	3	2.51	4.85	4.06	--	3	0.50	0.54	0.52	--
East San Pedro Bay	Dieldrin	3	0.05	0.05	0.05	3	3	0.045	0.045	0.050	3	3	0.05	0.05	0.05	3
East San Pedro Bay	Total DDx	3	33.8	95.6	64.1	--	3	41.1	135	80.2	--	3	7.18	18.1	11.3	--
East San Pedro Bay	Total PCBs	3	58.3	141	109	--	3	29.8	57.4	43.0	--	3	3.43	19.8	9.95	--
East San Pedro Bay	Toxaphene	3	0.31	0.31	0.31	3	3	0.305	0.305	0.310	3	3	0.31	0.31	0.31	3
LA Harbor Consolidated Slip	Chlordane	3	4.19	20.6	10.0	--	--	--	--	--	--	--	--	--	--	--
LA Harbor Consolidated Slip	Dieldrin	3	0.050	0.045	0.050	3	--	--	--	--	--	--	--	--	--	--
LA Harbor Consolidated Slip	Total DDx	3	60.8	259	131	--	--	--	--	--	--	--	--	--	--	--
LA Harbor Consolidated Slip	Total PCBs	3	56.6	194	129	--	--	--	--	--	--	--	---	--	--	--
LA Harbor Consolidated Slip	Toxaphene	3	0.310	0.305	0.310	3	--	--	--	--	--	--	--	--	--	--

Notes:

- Units: wet weight µg/kg
- ND: Non-detects are calculated as zero when summing PCBs, DDX, or chlordanes,
- DDX: Sum of all congeners.
- Field duplicates are averaged.

- If there was a result for Total PCB from the high-resolution congener, low-resolution congeners and aroclor method for a sample, only the high-resolution TPCB result was used for the analysis.
- Total chlordane results were calculated as the sum of alpha-chlordane, beta-chlordane, gamma-chlordane, oxychlordane, cis-nonachlor, and trans-nonachlor when available. If all the individual chemicals for a sample are non-detects, then maximum value of the individual analyte in the sum is used.
- (a) White Croaker – Fillet
- (b) Surfperch – Whole Body
- (c) California Halibut – Fillet

Data source: (Amec Foster Wheeler, 2016); (Anchor QEA, 2015)

Table 16 Fish Tissue Data (2016) for Greater Harbor Area

Sample Area	Chemical (µg/kg wet)	Sample Count (a)	Min Conc. (a)	Max Conc. (a)	Avg Conc. (a)	ND Sample Count (a)	Sample Count (b)	Min Conc. (b)	Max Conc. (b)	Avg Conc. (b)	ND Sample Count (b)	Sample Count (c)	Min Conc. (c)	Max Conc. (c)	Avg Conc. (c)	ND Sample Count (c)
LA Outer	Chlordane	3	0.44	0.45	0.44	3	2	0.44	0.45	0.44	2	3	0.44	0.44	0.44	3
LA Outer	Dieldrin	3	0.22	0.22	0.22	3	2	0.22	0.22	0.22	2	3	0.22	0.22	0.22	3
LA Outer	Total DDx	3	222	679	392	--	2	81.5	93.8	87.7	--	3	15.0	27.9	20.2	--
LA Outer	Total PCBs	3	106	207	143	--	2	32.7	35.8	34.3	--	3	6.63	12.5	9.25	--
LA Outer	Toxaphene	3	40.0	92.0	57.7	--	2	26.0	34.0	30.0	--	3	4.45	13.0	7.30	2
LB Outer	Chlordane	3	0.44	0.45	0.44	3	3	0.44	0.45	0.44	3	3	0.44	0.45	0.44	3
LB Outer	Dieldrin	3	0.22	0.22	0.22	3	3	0.22	0.22	0.22	3	3	0.22	0.22	0.22	3
LB Outer	Total DDx	3	255	425	347	--	3	33.4	48.3	38.8	--	3	8.53	16.7	12.7	--
LB Outer	Total PCBs	3	85.8	270	168	--	3	18.0	28.5	21.5	--	3	6.84	9.21	7.80	--
LB Outer	Toxaphene	3	32.0	83.0	54.0	--	3	11.0	22.0	18.3	--	3	4.45	4.50	4.48	3
East San Pedro Bay	Chlordane	3	0.44	0.45	0.44	3	3	0.44	0.45	0.44	3	3	0.44	0.45	0.44	3
East San Pedro Bay	Dieldrin	3	0.22	0.22	0.22	3	3	0.22	0.22	0.22	3	3	0.22	0.22	0.22	3
East San Pedro Bay	Total DDx	3	146	185	162	--	3	17.0	22.1	19.1	--	3	9.70	21.7	14.1	--
East San Pedro Bay	Total PCBs	3	180	290	231	--	3	18.0	29.9	23.0	--	3	9.20	11.2	10.5	--
East San Pedro Bay	Toxaphene	3	88.0	150	112	--	3	9.90	16.0	12.6	--	3	4.45	9.80	7.98	1
LA Harbor Consolidated Slip	Chlordane	3	0.45	0.45	0.45	3	--	--	--	--	--	--	--	--	--	--
LA Harbor Consolidated Slip	Dieldrin	3	0.22	0.22	0.22	3	--	--	--	--	--	--	--	--	--	--
LA Harbor Consolidated Slip	Total DDx	3	170	323	255	--	--	--	--	--	--	--	--	--	--	--
LA Harbor Consolidated Slip	Total PCBs	3	267	380	323	--	--	--	--	--	--	--	--	--	--	--
LA Harbor Consolidated Slip	Toxaphene	3	88.0	98.0	93.3	--	--	--	--	--	--	--	--	--	--	--

Notes:

- Units: wet weight µg/kg
- ND: Non-detects are calculated as zero when summing PCBs, DDX, or chlordanes,

- DDX: Sum of all congeners.
- Field duplicates are averaged.
- If there was a result for Total PCB from the high-resolution congeners, low-resolution congeners and aroclor method for a sample, only the high-resolution TPCB result was used for the analysis.
- Total chlordane results were calculated as the sum of alpha-chlordane, beta-chlordane, gamma-chlordane, oxychlordane, cis-nonachlor, and trans-nonachlor when available. If all the individual chemicals for a sample are non-detects, then maximum value of the individual analyte in the sum is used.
- (a) White Croaker – Fillet
- (b) Surfperch – Whole Body
- (c) California Halibut – Fillet

Data source: Anchor QEA 2018a

Average fish tissue concentrations were compared to the FCG and ATL3. Average concentrations higher than the FCG are in bold, while those higher than the FCG *and* ATL3 are in bold and underlined

Average fish tissue concentration for total DDT were above the FCG but below the ATL3 in 2014 and 2016 in all compliance sampling areas.

Average fish tissue concentration for total PCBs were above both the FCG and the ATL3 in 2014 and 2016 in all compliance sampling areas.

Dieldrin and toxaphene (included on the 303(d) list for Consolidated Slip) were not detected in 2014. In 2016, dieldrin was not detected in fish tissue but toxaphene was detected, and the average fish tissue concentrations were between the FCG and ATL3 target[2] in the Consolidated Slip.

Total chlordane was included on the 303(d) list for Consolidated Slip and East San Pedro Bay. In the Consolidated Slip, the average concentration was above the FCG target, but below the ATL3 target in 2014. Total chlordane was not detected in the 2016 samples for both Consolidated Slip and East San Pedro Bay.

[2] The analyzing laboratory, Anchor QEA, has reported a laboratory QA/method concern related to the toxaphene data collected in 2014/2016 and reported toxaphene data may later be revised.

Table 17 Fish Tissue Concentration (2014) Compared to Criteria

TMDL Area Name	Listed Compound	Mean Conc. Of Species Sampled (µg/kg wet)	FCG Fish Tissue Target (µg/kg wet)	ATL3 Fish Tissue Target (µg/kg wet)
LA Outer Harbor	Total Chlordane	1.0	5.6	190
LA Outer Harbor	Dieldrin	0.05	0.46	15
LA Outer Harbor	Total DDx	**100.3**	21	520
LA Outer Harbor	Total PCBs	**64**	3.6	21
LA Outer Harbor	Toxaphene	0.31	6.1	200
LB Outer Harbor	Total Chlordane	1.4	5.6	190
LB Outer Harbor	Dieldrin	0.05	0.46	15
LB Outer Harbor	Total DDx	**108**	21	520
LB Outer Harbor	Total PCBs	**92**	3.6	21
LB Outer Harbor	Toxaphene	0.31	6.1	200
East San Pedro Bay	Total Chlordane	4.0	5.6	190
East San Pedro Bay	Dieldrin	0.05	0.46	15
East San Pedro Bay	Total DDx	**52**	21	520
East San Pedro Bay	Total PCBs	**54**	3.6	21
East San Pedro Bay	Toxaphene	0.31	6.1	200
Consolidated Slip	Total Chlordane	**10**	5.6	190
Consolidated Slip	Dieldrin	0.05	0.46	15
Consolidated Slip	Total DDx	**131**	21	520
Consolidated Slip	Total PCBs	**129**	3.6	21
Consolidated Slip	Toxaphene	0.31	6.1	200

Table 18 Fish Tissue Concentration (2016) Comparison to Criteria

TMDL Area Name	Listed Compound	Mean Conc. Of Species Sampled (µg/kg wet)	FCG Fish Tissue Target (µg/kg wet)	ATL3 Fish Tissue Target (µg/kg wet)
LA Outer Harbor	Total Chlordane	0.44	5.6	190
LA Outer Harbor	Dieldrin	0.22	0.46	15
LA Outer Harbor	Total DDx	**167**	21	520
LA Outer Harbor	Total PCBs	**62**	3.6	21
LA Outer Harbor	Toxaphene	**32**	6.1	200
LB Outer Harbor	Total Chlordane	0.44	5.6	190
LB Outer Harbor	Dieldrin	0.22	0.46	15
LB Outer Harbor	Total DDx	**131**	21	520
LB Outer Harbor	Total PCBs	**66**	3.6	21
LB Outer Harbor	Toxaphene	**26**	6.1	200
East San Pedro Bay	Total Chlordane	0.44	5.6	190
East San Pedro Bay	Dieldrin	0.22	0.46	15
East San Pedro Bay	Total DDx	**65**	21	520
East San Pedro Bay	Total PCBs	**88**	3.6	21
East San Pedro Bay	Toxaphene	**44**	6.1	200
Consolidated Slip	Total Chlordane	0.45	5.6	190
Consolidated Slip	Dieldrin	0.22	0.46	15
Consolidated Slip	Total DDx	**255**	21	520
Consolidated Slip	Total PCBs	**323**	3.6	21
Consolidated Slip	Toxaphene	**93**	6.1	200

6.5 Summary of Data Review

Current water, sediment and fish tissue data were reviewed, including information collected through special studies and monitoring data required by the 2012 DC and Greater Harbor Waters TMDL.

The water column meets water quality standards in general, with the exception of some exceedances of copper, lead and zinc, especially in wet weather.

Sediment often exceeds the marine benthic health sediment guidelines and FCG-associated sediment targets, for metals, DDT and PCBs.

Sediments generally meet the SQOs for benthic health, with the exceptions of Consolidated Slip and Fish Harbor.

Fish tissue generally does not meet the FCGs, but sediments generally do meet human health SQOs, with the exception of Consolidated Slip, Fish Harbor and Eastern San Pedro Bay for PCBs.

References

Amec Foster Wheeler. (2016). *Draft Report. Harbor Toxics TMDL Special Study – Food Web Sampling. Prepared for Port of Los Angeles and Long Beach.* Retrieved February 2016

Anchor QEA. (2013b). *Technical Memorandum to Harbor Technical Working Group. Regarding: Harbor Toxics TMDL Special Study – Low Detection Sampling for PCBs and DDTs in the Water Column. Greater Los Angeles and Long Beach Harbor Waters.*

Anchor QEA. (2014a). *Data Gaps Analysis for Bioaccumulation Model Development. Prepared for Ports of Long Beach and Los Angeles. August 2014.*

Anchor QEA. (2015). *2014/15 Annual Report. Harbor Toxics TMDL Coordinated Compliance Monitoring and Reporting for the Greater Los Angeles and Long Beach Harbor Waters. December 2015.*

Anchor QEA. (2017a). *Bioaccumulation Model Report. In Support of Final Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters Toxic Pollutants Total Maximum Daily Load. Prepared for Ports of Long Beach and Los Angeles . April 2017.*

Anchor QEA. (2017b). *2015/16 Annual Report. Harbor Toxics TMDL Coordinated Compliance Monitoring and Reporting for the Greater Los Angeles and Long Beach Harbor Waters.*

Anchor QEA. (2018a). *2016/17 Annual Report. Harbor Toxics TMDL Coordinated Compliance Monitoring and Reporting for the Greater Los Angeles and Long Beach Harbor Waters.*

Anchor QEA. (2018b). *Fish Tissue Sampling and Analysis Plan. Greater Harbor Waters Regional Monitoring Coalition.*

Anchor QEA. (2018c). *2017/18 Annual Report. Harbor Toxics TMDL Coordinated Compliance Monitoring and Reporting for the Greater Los Angeles and Long Beach Harbor Waters.*

Anchor QEA and Latitude Environmental. (2018a). *Human Health Sediment Quality Objectives: Compliance Assessment Memorandum. December 6, 2018.*

Anchor QEA, LLC. and Latitude Environmental, Inc. (2018b). *Sediment Quality Objectives for Benthic Health: Area-Impacted Analysis and Compliance Assessment Memorandum.*

Arnot, J. (2016). *Concluding Comments on the Peer Review of Draft Bioaccumulation Model Report Greater Los Angeles and Long Beach Harbor Waters. December 16, 2016.*

Bridges, T.S. (2016a). *Comments on a Linked and Integrated Approach to Assessing Risks, TMDL Development, and Evaluating Alternative Management Actions for Greater Los Angeles and Long Beach Harbor Waters. November 28, 2016.*

Bridges, T.S. (2016b). *Concluding Comments on the Linked Models Applied to the TMDL for Greater Los Angeles and Long Beach Harbor Waters. December 14, 2016.*

Ramboll Environ and Weston. (2015). *Sampling and Analysis Report for Low Detection Limit Water Column Study Phase 2. .*

RWQCB and U.S. EPA. (2011). *Amendment to the Water Quality Control Plan - Los Angeles Region to Incorporate the TMDL for Toxic Pollutants in Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters.*

SCCWRP. (2016). *(Southern California Coastal Water Research Project), 2016. Southern California Bight 2013 Regional Monitoring Program: Volume IV. Sediment Chemistry. April 2016.*

SCCWRP. (2017). *User's guide for Human Health SQO Decision Support Tool (DST).*

SWRCB. (2018). *Amendment to the Water Quality Control Plan for Enclosed Bays and Estuaries of California - Sediment Quality Provisions. May 2018.*